

W Claim:

- 5 1. A woven sculpted fabric for the manufacture of a tissue web having a tissue contacting surface including at least a first group of strands and a second group of strands wherein the first group of strands extend in the cross-machine direction of the woven sculpted fabric and the second group of strands extend in the machine direction of the woven sculpted fabric and the first group of strands are adapted to
- 10 produce elevated floats and depressed sinkers, defining a three-dimensional fabric surface comprising:
- 15 a) a first background region having a set of substantially parallel first elevated floats separated by a set of substantially parallel first depressed sinkers, comprising first depressed sinkers positioned between adjacent first elevated floats and comprising first elevated floats positioned between adjacent first depressed sinkers;
 - 20 b) a second background region having a set of substantially parallel second elevated floats separated by a set of substantially parallel second depressed sinkers, comprising second depressed sinkers positioned between adjacent second elevated floats and comprising second elevated floats positioned between adjacent second depressed sinkers; and,
 - 25 c) a transition region positioned between the first and second background regions, wherein the first elevated floats of the first background region descend to become the second depressed sinkers of the second background region and the second elevated floats of the second background region descend to become the first depressed sinkers of the first background region.
- 30 2. The woven sculpted fabric of Claim 1, wherein at least one of the first elevated floats overlap at least one of the second elevated floats within the transition region.



3. The woven sculpted fabric of Claim 1, wherein the direction of the first group of strands is at an acute angle to the cross-machine direction.

4. The woven sculpted fabric of Claim 1, wherein the direction of the first group of strands is substantially orthogonal to the direction of the second group of strands.

5. The woven sculpted fabric of Claim 1, wherein at least one of the first depressed sinkers is a multi-strand first depressed sinker.

6. The woven sculpted fabric of Claim 1, wherein at least one of the second depressed sinkers is a multi-strand second depressed sinker.

7. The woven sculpted fabric of Claim 1, wherein at least one of the first elevated floats is a multi-strand first elevated float.

8. The woven sculpted fabric of Claim 1, wherein at least one of the second elevated floats is a multi-strand second elevated float.

9. The woven sculpted fabric of Claim 1, wherein the transition region has greater surface depth than the first background region.

10. The woven sculpted fabric of Claim 1, wherein the transition region has greater surface depth than the second background region.

11. The woven sculpted fabric of Claim 1, wherein the transition region is filled.

12. The woven sculpted fabric of Claim 1, wherein the transition region has substantially the same surface depth of the first background region.

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13. The woven sculpted fabric of Claim 1, wherein the transition region has substantially the same surface depth of the second background region.

14. The woven sculpted fabric of Claim 1, wherein the maximum plane difference of the first elevated floats is at least about 0.12 mm.

15. The woven sculpted fabric of Claim 1, wherein each of the first elevated floats has a width, and the maximum plane difference of the first elevated floats is at least about 30% of the width of one of the first elevated floats.

16. The woven sculpted fabric of Claim 1, wherein the maximum plane difference of the second elevated floats is at least about 0.12 mm.

17. The woven sculpted fabric of Claim 1, wherein each of the second elevated floats has a width, and the maximum plane difference of the second elevated floats is at least about 30% of the width of one of the second elevated floats.

18. The woven sculpted fabric of Claim 1, wherein the first background region has a first background texture and the second background region has a second background texture.

19. The woven sculpted fabric of Claim 18, wherein the first background texture of the first background region is substantially the same as the second background texture of the second background region.

20. The woven sculpted fabric of Claim 18, wherein the first background texture of the first background region is different than the second background texture of the second background region.

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- 5 **21.** The woven sculpted fabric of Claim 1, wherein each first elevated float has a first beginning point and a first ending point, each second elevated float has a second beginning point and a second ending point wherein the first ending point of at least one of the first elevated float is separated in the transition region by a gap having a width ranging from about 10 mm to about negative 10 mm from the second ending point of at least one of the nearest second elevated floats.
- 10 **22.** The woven sculpted fabric of Claim 21, wherein the gap has a width ranging from about 4 mm to about negative 4 mm.
- 23.** The woven sculpted fabric of Claim 1, wherein the maximum distance between adjacent first elevated floats is at least about 0.3 mm.
- 15 **24.** The woven sculpted fabric of Claim 23, wherein the maximum distance between adjacent first elevated floats is greater than the width of one of the adjacent first elevated floats.
- 20 **25.** The woven sculpted fabric of Claim 1, wherein the maximum distance between adjacent second elevated floats is at least about 0.3 mm.
- 26.** The woven sculpted fabric of Claim 25, wherein the maximum distance between adjacent second elevated floats is greater than the width of one of the adjacent second elevated floats.
- 25 **27.** The woven sculpted fabric of Claim 1, wherein the woven sculpted fabric is a forming wire.
- 28.** The woven sculpted fabric of Claim 1, wherein the woven sculpted fabric is a through air drying fabric.
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29. The woven sculpted fabric of Claim 1, wherein the woven sculpted fabric is a transfer fabric.

30. The woven sculpted fabric of Claim 1, wherein the tissue contacting surface
5 of the woven sculpted fabric is non-macroscopically monoplanar.

31. A woven sculpted fabric for the manufacture of a tissue web having a tissue
contacting surface including at least a first group of strands and a second group of
strands wherein the first group of strands extend in the cross-machine direction of
10 the woven sculpted fabric and the second group of strands extend in the machine
direction of the woven sculpted fabric and the first group of strands are adapted to
produce elevated floats and depressed sinkers, defining a three-dimensional fabric
surface comprising:

- 15 a) a first background region having a set of substantially parallel first
elevated floats separated by a set of substantially parallel first
depressed sinkers, comprising first depressed sinkers positioned
between adjacent first elevated floats and comprising first elevated
floats positioned between adjacent first depressed sinkers;
- 20 b) a second background region having a set of substantially parallel
second elevated floats separated by a set of substantially parallel
second depressed sinkers, comprising second depressed sinkers
positioned between adjacent second elevated floats and comprising
second elevated floats positioned between adjacent second
depressed sinkers; and,
- 25 c) a transition region positioned between the first and second
background regions, wherein the first elevated floats of the first
background region become the second elevated floats of the second
background region and the first depressed sinkers of the first
background region become the second depressed sinkers of the
30 second background region.

32. The woven sculpted fabric of Claim 31, wherein at least one of the first elevated floats overlap at least one of the second elevated floats within the transition region.

5 **33.** The woven sculpted fabric of Claim 31, wherein the direction of the first group of strands is at an acute angle to the cross-machine direction of the woven sculpted fabric.

10 **34.** The woven sculpted fabric of Claim 31, wherein the direction of the first group of strands is substantially orthogonal to the direction of the second group of strands.

15 **35.** The woven sculpted fabric of Claim 31, wherein at least one of the first depressed sinkers is a multi-strand first depressed sinker.

36. The woven sculpted fabric of Claim 31, wherein at least one of the second depressed sinkers is a multi-strand second depressed sinker.

20 **37.** The woven sculpted fabric of Claim 31, wherein at least one of the first elevated floats is a multi-strand first elevated float.

38. The woven sculpted fabric of Claim 31, wherein at least one of the second elevated floats is a multi-strand second elevated float.

25 **39.** The woven sculpted fabric of Claim 31, wherein the transition region has greater surface depth than the first background region.

30 **40.** The woven sculpted fabric of Claim 31, wherein the transition region has greater surface depth than the second background region.

41. The woven sculpted fabric of Claim 31, wherein the transition region is filled.

42. The woven sculpted fabric of Claim 31, wherein the transition region has substantially the same surface depth of the first background region.

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43. The woven sculpted fabric of Claim 31, wherein the transition region has substantially the same surface depth of the second background region.

44. The woven sculpted fabric of Claim 31, wherein the transition region is filled with a polymeric resin.

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45. The woven sculpted fabric of Claim 31, wherein the maximum plane difference of the first elevated floats is at least about 0.12 mm.

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46. The woven sculpted fabric of Claim 31, wherein each of the first elevated floats has a width, and the maximum plane difference of the first elevated floats is at least about 30% of the width of one of the first elevated floats.

47. The woven sculpted fabric of Claim 31, wherein the maximum plane difference of the second elevated floats is at least about 0.12 mm.

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48. The woven sculpted fabric of Claim 31, wherein each of the second elevated floats has a width, and the maximum plane difference of the second elevated floats is at least about 30% of the width of one of the second elevated floats.

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49. The woven sculpted fabric of Claim 31, wherein the first background region has a first background texture and the second background region has a second background texture.

50. The woven sculpted fabric of Claim 49, wherein the first background texture of the first background region is substantially the same as the second background texture of the second background region.

- 5 **51.** The woven sculpted fabric of Claim 49, wherein the first background texture of the first background region is different than the second background texture of the second background region.

- 10 **52.** The woven sculpted fabric of Claim 31, wherein each first elevated float has a first beginning point and a first ending point, each second elevated float has a second beginning point and a second ending point wherein the first ending point of at least one of the first elevated float is separated in the transition region by a gap having a width ranging from about 10 mm to about 0 mm from the second ending point of at least one of the nearest second elevated floats.

- 15 **53.** The woven sculpted fabric of Claim 52, wherein the gap has a width ranging from about 4 mm to about 0 mm.

- 20 **54.** The woven sculpted fabric of Claim 31, wherein the maximum distance between adjacent first elevated floats is at least about 0.3 mm.

- 25 **55.** The woven sculpted fabric of Claim 54, wherein the maximum distance between adjacent first elevated floats is greater than the width of one of the adjacent first elevated floats.

- 56.** The woven sculpted fabric of Claim 31, wherein the maximum distance between adjacent second elevated floats is at least about 0.3 mm.

- 30 **57.** The woven sculpted fabric of Claim 56, wherein the maximum distance between adjacent second elevated floats is greater than the width of one of the adjacent second elevated floats.

58. The woven sculpted fabric of Claim 31, wherein woven sculpted fabric is a forming wire.

59. The woven sculpted fabric of Claim 31, wherein woven sculpted fabric is a through air drying fabric.

60. The woven sculpted fabric of Claim 31, wherein woven sculpted fabric is a transfer fabric.

61. The woven sculpted fabric of Claim 31, wherein the tissue contacting surface of the woven sculpted fabric is non-macroscopically monoplanar.

62. A method of making a tissue product comprising:

- a) depositing an aqueous suspension of papermaking fibers onto a forming fabric thereby forming a wet tissue web;
- b) transferring the wet tissue web to a woven sculpted fabric having a tissue contacting surface including at least a first group of strands and a second group of strands wherein the first group of strands extend in the cross-machine direction of the woven sculpted fabric and the second group of strands extend in the machine direction of the woven sculpted fabric and the first group of strands are adapted to produce elevated floats and depressed sinkers, defining a three-dimensional fabric surface comprising:
 - i) a first background region having a set of substantially parallel first elevated floats separated by a set of substantially parallel first depressed sinkers, comprising first depressed sinkers positioned between adjacent first elevated floats and comprising first elevated floats positioned between adjacent first depressed sinkers;
 - ii) a second background region having a set of substantially parallel second elevated floats separated by a set of

- substantially parallel second depressed sinkers, comprising second depressed sinkers positioned between adjacent second elevated floats and comprising second elevated floats positioned between adjacent second depressed sinkers; and,
- 5 iii) a transition region positioned between the first and second background regions, wherein the first elevated floats of the first background region descend to become the second depressed sinkers of the second background region and the second elevated floats of the second background region descend to become the first depressed sinkers of the first background region; and,
- 10 c) drying the wet tissue web.

63. The method of Claim 62, wherein the wet tissue web has a consistency of at least about 20 percent when the wet tissue web is transferred to the woven sculpted fabric.

64. The method of Claim 62, wherein drying the wet tissue web comprises noncompressive drying.

65. The method of Claim 64, wherein the noncompressive drying of the wet tissue web comprises through air drying on a throughdrying fabric thereby forming a dried tissue web.

66. The method of Claim 65, wherein the speed of the throughdrying fabric is from about 10 to about 80 percent slower than the speed of the forming fabric.

67. The method of Claim 65, further comprising transferring the wet tissue web from the forming fabric to a transfer fabric before transferring the wet tissue web to the throughdrying fabric, wherein the speed of the transfer fabric is from about 10 to about 80 percent slower than the speed of the forming fabric.

68. The method of Claim 67, wherein the speed of the transfer fabric is substantially the same as the speed of the woven sculpted fabric.

69. The method of Claim 62, wherein at least one of the first elevated floats
5 overlap at least one of the second elevated floats within the transition region of the woven sculpted fabric.

70. The method of Claim 62, wherein the direction of the first group of strands of
10 the woven sculpted fabric is in the cross-machine direction.

71. The method of Claim 62, wherein the direction of the first group of strands of
the woven sculpted fabric is at an acute angle to the cross-machine direction.

72. The method of Claim 62, wherein the direction of the first group of strands of
15 the woven sculpted fabric is substantially orthogonal to the second direction of the second group of strands of the woven sculpted fabric.

73. The method of Claim 62, wherein at least one of the first depressed sinkers
20 of the woven sculpted fabric is a multi-strand first depressed sinker.

74. The method of Claim 62, wherein at least one of the second depressed
sinker of the woven sculpted fabric is a multi-strand second depressed sinker.

75. The method of Claim 62, wherein at least one of the first elevated floats of
25 the woven sculpted fabric is a multi-strand first elevated float.

76. The method of Claim 62, wherein at least one of the second elevated floats of
the woven sculpted fabric is a multi-strand second elevated float.

77. The method of Claim 62, wherein the transition region has greater surface depth than the first background region.

78. The method of Claim 62, wherein the transition region has greater surface
5 depth than the second background region.

79. The method of Claim 62, wherein the transition region is filled.

80. The method of Claim 62, wherein the transition region has substantially the
10 same surface depth of the first background region.

81. The method of Claim 62, wherein the transition region has substantially the
same surface depth of the second background region.

82. The method of Claim 62, wherein the transition region is filled with a
15 polymeric resin.

83. The method of Claim 62, wherein the maximum plane difference of the first
elevated floats is at least about 0.12 mm.

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84. The method of Claim 62, wherein each of the first elevated floats has a width,
and the maximum plane difference of the first elevated floats is at least about 30%
of the width of one of the first elevated floats.

85. The method of Claim 62, wherein the maximum plane difference of the
25 second elevated floats is at least about 0.12 mm.

86. The method of Claim 62, wherein each of the second elevated floats has a
width, and the maximum plane difference of the second elevated floats is at least
30 about 30% of the width of one of the second elevated floats.

87. The method of Claim 62, wherein the first background region has a first background texture and the second background region has a second background texture.

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88. The method of Claim 87, wherein the first background texture of the first background region is substantially the same as the second background texture of the second background region.

10 **89.** The method of Claim 87, wherein the first background texture of the first background region is different than the second background texture of the second background region.

15 **90.** The method of Claim 62, wherein each first elevated float has a first beginning point and a first ending point, each second elevated float has a second beginning point and a second ending point wherein the first ending point of at least one of the first elevated float is separated in the transition region by a gap having a width ranging from about 10 mm to about negative 10 mm from the second ending point of at least one of the nearest second elevated floats.

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91. The method of Claim 90, wherein the gap has a width ranging from about 4 mm to about negative 4 mm.

25 **92.** The method of Claim 62, wherein the maximum distance between adjacent first elevated floats is at least about 0.3 mm.

93. The method of Claim 92, wherein the maximum distance between adjacent first elevated floats is greater than the width of one of the adjacent first elevated floats.

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94. The method of Claim 62, wherein the maximum distance between adjacent second elevated floats is at least about 0.3 mm.

95. The method of Claim 94, wherein the maximum distance between adjacent second elevated floats is greater than the width of one of the adjacent second elevated floats.

96. The method of Claim 62, wherein the wet tissue web is macroscopically rearranged to conform to the tissue contacting surface of the woven sculpted fabric.

97. The method of Claim 62, wherein the woven sculpted fabric is a forming wire.

98. The method of Claim 65, wherein the wet tissue web is at least partially throughdried on the woven sculpted fabric.

99. The method of Claim 62, wherein the woven sculpted fabric is a transfer fabric.

100. A tissue product made by the method of Claim 62.

101. The tissue product of Claim 100, wherein the tissue product has a density that is substantially uniform.

102. The tissue product of Claim 100, wherein the tissue product has a machine direction stretch of greater than about 10 percent, further comprising a softness agent disposed on a surface of the tissue product.

103. The method of Claim 62, wherein the tissue contacting surface of the woven sculpted fabric is non-macroscopically monoplanar.

104. The method of Claim 65, wherein the dried tissue web is not creped.

105. The method of Claim 65, wherein the dried tissue web is transferred to a
5 Yankee dryer thereby providing a dried tissue web.

106. The method of Claim 105, wherein the dried tissue web is removed from the
Yankee dryer without creping.

10 **107.** The method of Claim 105, wherein the dried tissue web is removed from the
Yankee dryer with creping.

108. The method of Claim 65, further comprising dewatering the wet tissue web
by at least one of displacement dewatering, capillary dewatering, and application of
15 an air press.

109. The method of Claim 65, further comprising dewatering the wet tissue web
by at least one of impulse drying, radiofrequency drying, long nip pressing, wet
pressing, steam drying, high intensity nip drying, and infrared drying.

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110. The method of Claim 62, wherein the wet tissue web is treated with a
chemical strength agent and creped two or more times.

111. A method of making a tissue product comprising:

- 25 a) depositing an aqueous suspension of papermaking fibers onto a
 forming fabric thereby forming a wet tissue web;
- b) transferring the wet tissue web to a woven sculpted fabric having a
 tissue contacting surface including at least a first group of strands
 and a second group of strands wherein the first group of strands
30 extend in the cross-machine direction of the woven sculpted fabric
 and the second group of strands extend in the machine direction of

the woven sculpted fabric and the first group of strands are adapted to produce elevated floats and depressed sinkers, defining a three-dimensional fabric surface comprising:

- i) a first background region having a set of substantially parallel first elevated floats separated by a set of substantially parallel first depressed sinkers, comprising first depressed sinkers positioned between adjacent first elevated floats and comprising first elevated floats positioned between adjacent first depressed sinkers;
 - ii) a second background region having a set of substantially parallel second elevated floats separated by a set of substantially parallel second depressed sinkers, comprising second depressed sinkers positioned between adjacent second elevated floats and comprising second elevated floats positioned between adjacent second depressed sinkers; and,
 - iii) a transition region positioned between the first and second background regions, wherein the first elevated floats of the first background region become the second elevated floats of the second background region and the first depressed sinkers of the first background region become the second depressed sinkers of the second background region; and,
- c) drying the wet tissue web.

112. The method of Claim 111, wherein the wet tissue web has a consistency of at least about 20 percent when the wet tissue web is transferred to the woven sculpted fabric.

113. The method of Claim 111, wherein drying of the wet tissue web comprises noncompressive drying.

114. The method of Claim 113, wherein the noncompressive drying of the wet tissue web comprises through air drying on a throughdrying fabric thereby forming a dried tissue web.

5 **115.** The method of Claim 114, wherein the speed of the throughdrying fabric is from about 10 to about 80 percent slower than the speed of the forming fabric.

10 **116.** The method of Claim 114, further comprising transferring the wet tissue web from the forming fabric to a transfer fabric before transferring the wet tissue web to the throughdrying fabric wherein the speed of the transfer fabric is from about 10 to about 80 percent slower than the speed of the forming fabric.

15 **117.** The method of Claim 116, wherein the speed of the transfer fabric is substantially the same as the speed of the woven sculpted fabric.

118. The method of Claim 111, wherein at least one of the first elevated floats overlap at least one of the second elevated floats within the transition region.

20 **119.** The method of Claim 111, wherein the direction of the first group of strands is in the cross-machine direction.

120. The method of Claim 111, wherein the direction of the first group of strands is at an acute angle to the cross-machine direction.

25 **121.** The method of Claim 111, wherein the direction of the first group of strands is substantially orthogonal to the second direction of the second group of strands.

30 **122.** The method of Claim 111, wherein at least one of the first depressed sinkers is a multi-strand first depressed sinker.

123. The method of Claim 111, wherein at least one of the second depressed sinkers is a multi-strand second depressed sinker.

124. The method of Claim 111, wherein at least one of the first elevated floats is
5 a multi-strand first elevated float.

125. The method of Claim 111, wherein at least one of the second elevated floats is a multi-strand second elevated float.

126. The method of Claim 111, wherein the transition region has greater surface
10 depth than the first background region.

127. The method of Claim 111, wherein the transition region has greater surface
depth than the second background region.

128. The method of Claim 111, wherein the transition region is filled.
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129. The method of Claim 111, wherein the transition region has substantially
the same surface depth of the first background region.

130. The method of Claim 111, wherein the transition region has substantially
20 the same surface depth of the second background region.

131. The method of Claim 111, wherein the transition region is filled with a
25 polymeric resin.

132. The method of Claim 111, wherein the maximum plane difference of the
first elevated floats is at least about 0.12 mm.

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- 133.** The method of Claim 111, wherein each of the first elevated floats has a width, and the maximum plane difference of the first elevated floats is at least about 30% of the width of one of the first elevated floats.
- 5 **134.** The method of Claim 111, wherein the maximum plane difference of the second elevated floats is at least about 0.12 mm.
- 135.** The method of Claim 111, wherein each of the second elevated floats has a width, and the maximum plane difference of the second elevated floats is at least about 30% of the width of one of the second elevated floats.
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- 136.** The method of Claim 111, wherein the first background region has a first background texture and the second background region has a second background texture.
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- 137.** The method of Claim 136, wherein the first background texture of the first background region is substantially the same as the second background texture of the second background region.
- 20 **138.** The method of Claim 136, wherein the first background texture of the first background region is different than the second background texture of the second background region.
- 139.** The method of Claim 111, wherein each first elevated float has a first beginning point and a first ending point, each second elevated float has a second beginning point and a second ending point wherein the first ending point of at least one of the first elevated float is separated in the transition region by a gap having a width ranging from about 10 mm to about 0 mm from the second ending point of at least one of the nearest second elevated floats.
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140. The method of Claim 139, wherein the gap has a width ranging from about 4 mm to about 0 mm.

141. The method of Claim 111, wherein the maximum distance between adjacent first elevated floats is at least about 0.3 mm.

142. The method of Claim 141, wherein the maximum distance between adjacent first elevated floats is greater than the width of one of the adjacent first elevated floats.

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143. The method of Claim 111, wherein the maximum distance between adjacent second elevated floats is at least about 0.3 mm.

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144. The method of Claim ¹⁴³~~144~~, wherein the maximum distance between adjacent second elevated floats is greater than the width of one of the adjacent second elevated floats.

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145. The method of Claim 111, wherein the wet tissue web is macroscopically rearranged to conform to the tissue contacting surface of the woven sculpted fabric.

146. The method of Claim 111, wherein the woven sculpted fabric is a forming wire.

147. The method of Claim 111, wherein the wet tissue web is at least partially throughdried woven sculpted fabric.

148. The method of Claim 111, wherein the woven sculpted fabric is a transfer fabric.

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149. A tissue product made by the method of Claim 111.

150. The tissue product of Claim 149, wherein the tissue product has a density that is substantially uniform.

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151. The tissue product of Claim 149, wherein the tissue product has a cross-machine direction stretch of greater than about 10 percent.

152. The method of Claim 111, wherein the tissue contacting surface of the woven sculpted fabric is non-macroscopically monoplanar.

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153. The method of Claim 114, wherein the dried tissue web is not creped.

154. The method of Claim 114, wherein the dried tissue web is transferred to a Yankee dryer thereby providing a dried tissue web.

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155. The method of Claim 154, wherein the dried tissue web is removed from the Yankee dryer without creping.

156. The method of Claim 154, wherein the dried tissue web is removed from the Yankee dryer with creping.

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157. The method of Claim 114, further comprising dewatering the wet tissue web by at least one of displacement dewatering, capillary dewatering, and application of an air press.

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158. The method of Claim 114, further comprising dewatering the wet tissue web by at least one of impulse drying, radiofrequency drying, long nip pressing, wet pressing, steam drying, high intensity nip drying, and infrared drying.

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159. The method of Claim 111, wherein the wet tissue web is treated with a chemical strength agent and creped two or more times.

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